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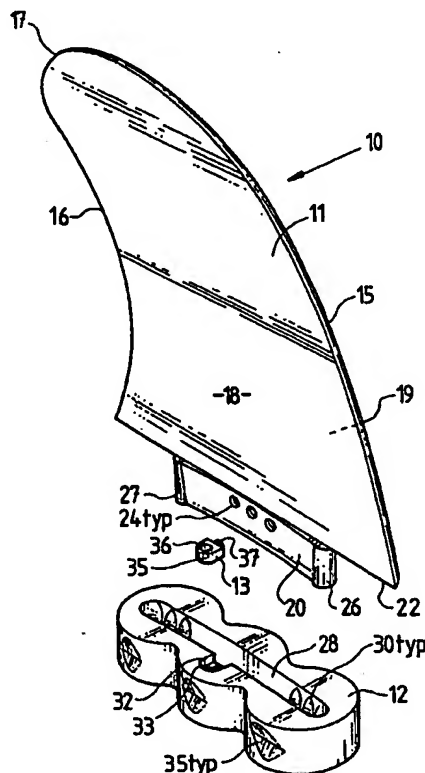
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : B63B 35/79	A1	(11) International Publication Number: WO 00/32466 (43) International Publication Date: 8 June 2000 (08.06.00)
(21) International Application Number: PCT/AU99/01067 (22) International Filing Date: 1 December 1999 (01.12.99) (30) Priority Data: PP 7441 1 December 1998 (01.12.98) AU (71)(72) Applicant and Inventor: MILNE, John De Courcey [AU/AU]; 76 Stanley Terrace, Taringa, QLD 4068 (AU). (74) Agent: AHEARNES; G.P.O. Box 1149, Brisbane, QLD 4001 (AU).	(81) Designated States: AU, BR, JP, NZ, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	

(54) Title: SURFBOARDS AND FITTINGS FOR SURFBOARDS

(57) Abstract

A fin assembly (10) including one or more fin boxes (12) adapted to be fixedly mounted in the board of a surfboard, and a fin (11), the fin and the fin box(es) having complementary locating means (30) for locating the fin in any one of a plurality of predetermined fore and aft positions relative to the fin box(es), and securing means (13) adapted to engage with the fin and at least one of the fin boxes to secure the fin in any selected one of the plurality of predetermined positions, the parts being so made and arranged that the angle of attack of the fin can be varied by locating the fin in one of the predetermined fore and aft positions.



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"SURFBOARDS AND FITTINGS FOR SURFBOARDS"

TECHNICAL FIELD

THIS INVENTION relates to surfboards and fittings for surfboards, particularly fins and leg rope plugs and surfboards
5 incorporating such fittings. However, the invention may also have application to other aquafoils such as surf skis and the like and fittings therefor.

BACKGROUND ART

Since about 1948, fins have become an increasingly important
10 fitting on the underside of surfboards, and they now commonly have up to three fins fitted during the manufacturing process.

It is generally recognised that beginners can learn to ride a surfboard more easily if the fins are arranged for stability
in motion through the water which generally requires that the
15 fins to be as far aft as possible. However, more advanced riders sometimes prefer to have the fins located further forward to make it easier to turn the surfboard.

In two-fin surfboards, the fins are generally angled to the line of the board with their leading edges facing slightly
20 inwards which is believed to increase the maneuverability of the surfboard, although it increases drag. The inward angle, often referred to as the "attack angle" or "angle of attack", is usually within a range that has the axes of the fins (or the outer two fins on a three-fin board) intersecting along the centre-line of
25 the surfboard near to, but forward of, the bow or nose of the surfboard. Also, the outer fins are sometimes slanted outward. In some surfing conditions, or in order to suit particular surfers or surfing maneuvers, it is believed to be advantageous to have the intersection point located off to one side of the
30 centre-line of the board or to change the attack angle, which has required the use of a different board in those conditions.

Different fin fixing techniques have been used for fixing fins to aquafoils, including a removable fin arrangement for surfboards. For example, Australian Patent Specification No.
35 693962 discloses an arrangement which permits a fin to be inserted into and removed from a fin box set into the board. The fin has a tab which may be inserted into a central slot in a

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plug, allowing the fin to self-align to an angle where it reduces drag and cavitation. By way of further example, United States Patent No. 5,567,190, discloses a surfboard in which the fin is secured by way of a fin box which has a longitudinal slot for receiving respective base portions of the fin, with two devices, one at each end of the slot or base portion for adjusting the abeam location of the fore end aft ends of the fin relative to the board thereby providing adjustment of the attack angle of the fin. However, the adjustment appears to be too coarse, inaccurate and imprecise for practical purposes and also appears not to hold the fin as firm as desired.

Another fitting commonly found on surfboards is a leg rope plug which is typically inserted into a cavity formed in the board near the tail or stern either during or after manufacture. The cavity extends through the skin and into the core or "blank" of the board. The plug is typically 20 mm deep to give sufficient surface area for bonding with epoxy cement to hold the considerable forces applied by a leg roped rider. However, the plug cannot be placed as close to the end of the board as desired because the board is too thin near the ends to house the plug.

United States Patent Specification No. 5,795,205 discloses a U-shaped passage arranged parallel to the deck of the surfboard formed with its two ends opening directly to the aft end of the surfboard for attaching a leg rope or leash by threading the rope through the passage. However, with such an arrangement, the leg rope trails in the water during surfing, and thus increases drag and decreases maneuverability, the leg rope not exiting to the deck of the surf board at all.

It is an object of the invention to provide a fin assembly in which the attack angle of a fin is adjustable and which alleviates one or more of the problems of the prior art. A further object of the invention is to provide a fitting for attachment of a leg rope to a surfboard which allows the leg rope to be effectively attached close to the aft end of the surfboard. Other objects and advantages of the present invention may become apparent from the following description.

DISCLOSURE OF INVENTION

With the foregoing in view, this invention in one aspect resides broadly in a fin assembly including one or more fin boxes adapted to be fixedly mounted in the board of a surfboard, and a fin, said fin and said one or more fin boxes having complementary locating means for locating said fin in any one of a plurality of predetermined fore and aft positions relative to said one or more fin boxes, and securing means adapted to engage with said fin and at least one of said one or more fin boxes to secure said fin in any selected one of said plurality of predetermined positions, the parts being so made and arranged that the angle of attack of said fin can be varied by locating said fin in a different or different ones of said predetermined fore and aft positions. Advantageously, the invention provides for movement of the fins to a more forward position while at the same time adjusting the attack angle to a position in which the leading edges are toed in. That is to say, more advanced riders can derive benefit from adjustment to two parameters. Furthermore, a rider can purchase a surfboard which is suitable for use as a beginner and which can be adjusted to suit as he advances in skill.

Preferably, the complementary locating means include two spaced apart projections at the base of the fin and a plurality of pairs of complementary recesses in the one or more fin boxes, each pair of recesses being adapted to receive therein the spaced apart projections and the pairs of recesses being arranged on a curve to vary the angle of attack. More preferably, the one or more fin boxes is one elongate fin box and the pairs of complementary recesses are formed as part of an elongate recess in the fin box, at least a portion of the sidewalls of the recess converging into the recess, and the spaced apart projections being interconnected by a bridging portion extending therebetween and having side faces which converge away from the base of the fin and being adapted to bind with the side walls of the elongate recess. In a preferred embodiment, there are three pairs of complementary recesses arranged on a curve and spaced apart so as to provide adjustment of the attack angle of about 0.6 degrees

between respective pairs, and the three pairs of complementary recesses are spaced apart by 6 mm. Thus, in that embodiment the fin is receivable into a selection of discrete locations in the fin box.

5 Preferably, the elongate recess and the bridging portion have a complementary curvature along their respective lengths whereby the bridging portion may bind with the side walls of the recess when the fin is in any one of the plurality of predetermined positions.

10 Preferably, a plurality of apertures or cavities are provided in the bridging portion and opening to a side face and the securing means includes a securing member having a portion adapted to engage in any selected one of the apertures and to be fixed to the fin box, by a screw or other suitable fixing
15 element.

 In another aspect, the invention resides broadly in a fin box or a pair of fin boxes adapted to be fixedly mounted in the board of a surfboard, the fin box or the pair of fin boxes together having a plurality of pairs of spaced apart recesses
20 adapted to receive therein complementary spaced apart projections at the base of a fin to be mounted in said fin box or said pair of fin boxes each pair of recesses being arranged on a curve to vary the angle of attack.

 In another aspect the invention resides broadly in a fin
25 having two spaced apart projections at the base of the fin interconnected by a bridging portion extending therebetween and having side faces which converge away from the base of the fin.

 In another aspect, the invention resides broadly in a surfboard having a board and one or more fin assemblies as herein
30 described thereto mounted. Preferably, two fin assemblies are provided, one either side of an elongate axis or a central fin of the surfboard, and wherein the attack angle is adjustable from being aligned substantially parallel to the elongate central axis to being aligned with a selected point along the axis aft from
35 the bow or nose of the board or on one side or the other of the axis. The point on one side may be selected to help the rider steer the board in some wave conditions. The preferred form

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having three pairs of recesses giving a maximum variation of 1.2 degrees allows the point of intersection to be located as described for common length surfboards of about 1800 mm to 1900 mm for common fin spacings.

5 In a further aspect, this invention resides broadly in a surfboard having a board and one or more fins preferably as previously described, fixed to the board, the board having a core covered with a skin of water impermeable material; a stringer
10 extending along the longitudinal axis of the board to give longitudinal strength to the board; and a passage passing laterally through the stringer and outward through the core to penetrate the skin on each side of the stringer, the passage being adapted to receive therethrough a leg rope.

Preferably, the passage penetrates the deck of the board in
15 close proximity to the aft end thereof. It is also preferred that the passage is lined with a tubular member placed inside the passage and sealed to the water impermeable skin to prevent leakage into the core. Once the leg rope is passed through the passage, it may be tied back onto itself to form a loop to be
20 threaded through the aperture, with the other end of the rope being attached to an ankle strap in the normal manner.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that this invention may be more readily understood and put into practical effect, reference will now be made to the
25 following drawings which illustrate preferred embodiments of the invention, and wherein:

- Fig. 1 is an exploded perspective view of a fin assembly for a surfboard in accordance with the invention;
Fig. 2 is a side view of the fin shown in the fin assembly
30 of Fig. 1;
Fig. 3 is a sectional plan view of the fin of Fig. 2 along lines 3-3 of Fig. 2;
Fig. 4 is a plan view of the fin box shown in the fin assembly of Fig. 1;
35 Fig. 5 is a plan view of the securing lug shown in the fin assembly of Fig. 1;
Fig. 6 is a side view of an alternative fin in accordance

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with the invention for use with the fin box of Fig. 4;
Fig. 7 is a sectional plan view of the alternative fin of
Fig. 6 along lines 7-7 of Fig. 6;
Fig. 8 is another plan view of the fin box of Fig. 4
5 reproduced to assist in the illustration of the invention
with the fin of Fig. 6;
Fig. 9 is a plan view of an alternative securing lug for
the fin of Fig. 6;
Fig. 10 is a diagrammatic exploded sectional rear end view
10 of the fin assembly of Fig. 1;
Fig. 11 is a partly broken away end view of the fin
assembly of Fig. 10 fully assembled;
Figs. 12 is a side view of another fin according to the
invention;
15 Fig. 13 is a front view of the fin of Fig. 12;
Fig. 14 is a sectional view of an alternative fin box for
mounting the fin of Fig. 12 on a board;
Fig. 15 is a sectional front view of the fin and
alternative of Figs. 12 and 14;
20 Figs. 16 and 17 are diagrammatic side views of two
respective examples of alternative assembled positions of
the fin and fin box of Figs. 12 and 14;
Fig. 18 is a side view of another fin according to the
invention;
25 Fig. 19 is a plan view of the fin of Fig. 18;
Fig. 20 is a plan view of a fin box for mounting the fin of
Fig. 18;
Fig. 21 shows in plan view an example of a position of the
fin of Fig. 18 in the fin box of Fig. 20;
30 Fig. 22 is a sectional plan view of another fin for a
surfboard according to the invention;
Figs 23, 24 and 25 show in sectional plan view three
examples of different positions of the fin of Fig. 20 in a
fin box according to the invention;
35 Figs. 26, 27 and 28 show in diagrammatic plan view three
examples of the different positions in which the two fins
of a surfboard may be placed using the fin assembly of Fig.

1;

Fig. 29 is a side view of a tube insert for a leg rope fitting according to the invention;

5 Fig. 30 is a partial sectional side view of a leg rope fitting fitted in a surfboard using the tube insert of Fig. 29;

Figs. 31 and 32 are partial sectional side views representing two of the manufacturing steps in providing the leg rope fitting of Figs. 29 and 30;

10 Figs. 33 and 34 are partial sectional side views representing two of the manufacturing steps in providing an alternative leg rope fitting according to the invention;

Fig. 35 is a diagrammatic partial plan view of the leg rope fitting of Figs. 33 and 34;

15 Fig. 36 is a partial sectional plan view of the leg rope fitting of Fig. 35;

Fig. 37 is a diagrammatic partial plan view of the leg rope fitting of Figs. 29 and 30;

20 Fig. 38 is a partial sectional side view of any one of the leg rope fitting of Figs. 29 to 37;

Fig. 39 is a diagrammatic partial sectional side view showing a leg rope attached to the leg rope fitting of Fig. 38;

25 Fig. 40 is a pictorial representation of a tail portion of a surfboard according to the invention with a pair of the fin assemblies of Fig. 1 fixed to the board; and

30 Fig. 41 is a pictorial representation of the surfboard of Fig. 40 in its normal orientation for surfing, and also showing the leg rope fitting as shown in Fig. 32 fixed to the board.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to Fig. 1, the fin assembly 10 comprises a fin 11, a fin box 12, and a securing member or lug 13. The fin has a curved leading edge 15, a curved trailing edge 16 and a curved tip 17 in accordance with well known fin profiles. The visible face 18 of the fin shown is planar, the other side 19 being convex. The curved tip slants slightly away from view in Fig. 1,

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as seen more readily in Figs. 10 and 11.

The fin assembly shown in Fig. 1 is a left fin assembly (when the board is in its normal orientation with the fins downward and viewed from the nose to the tail), but the fins of Figs. 2 to 9 are right fin assemblies, being mirror images of the fin of Fig. 1. The fin has a substantially straight lower edge 22 along its base for abutment against the underside of a board, the fin assembly being inverted in use from the orientation shown, but such terms as upper and lower are not to be construed as limiting the invention to any particular orientation.

Two spaced apart projections in the form of a fore locating post 26 and an aft locating post 27 depend from the straight edge, and are connected by a curved tongue 20 bridging therebetween, the visible side of the tongue being concave, and having three spaced apart blind openings which function as locating apertures shown typically at 24. The tongue is insertable into a curved slot 28 provided in the fin box as will be described in more detail later. The fin box is trilobial in plan view and generally prismatic in form, the lobes abutting and being generally collinear. The side of each lobe are intersected by a V-shaped channel shown typically at 35, each channel being aligned with the elongate axis of the fin box which penetrates only part-way into both sides of the fin box and is intended to act as a key to help bond the fin box to the board.

The sidewalls of the curved slot converge such that the slot is tapered to match a corresponding tapering of the tongue, and includes six pairs of recesses shown typically at 30 for receiving a locating post, the locating posts being partly cylindrical, and pairs of recesses being complementary portions of cylinders sized to a clearance fit for receiving either the fore or the aft locating post. Thus, the fin may be located in one of three locations in the fin box, the spacing between the recesses corresponding to the spacing between the locating apertures.

A D-shaped land 32 is formed into the concave side of the slot, and has a hole 33 for receiving a screw substantially vertically in the orientation illustrated. The securing lug 13

has a D-shaped portion 35 in plan view corresponding to the shape of the D-shaped land beside the slot, and a cylindrical portion 37 extending from the flat side of the "D", the size of the cylindrical portion corresponding to the size of the locating apertures so that the cylindrical portion may be engaged in any one of the locating apertures. When, for example, the fin is located in its forward most location in the fin box, the securing lug is engaged in the aft most locating aperture, and the fin is held firmly in place by inserting a screw through a lug aperture in the D-shaped portion of the securing lug and into the screw hole in the fin box and tightened to wedge the tapered tongue into the tapered slot.

Referring to Figs. 6 to 9, the fin 21 is the same as the fin 11 described in relation to Figs. 1 to 5 in every respect except that the tongue, referred to hereinafter as the alternative tongue 22, has a securing slot 25 instead of the locating apertures 24. The alternative securing lug 14 has a tenon portion extending from its D-shaped portion 35 instead of the cylindrical portion in the case of the securing lug 13 described in relation to Fig. 5.

Referring to Figs. 10 and 11, it can be seen that the fin assembly 10 may be fitted together by first inserting the securing lug 13 (or 14) with its cylindrical portion 37 (or tenon portion 38) into one locating aperture 24 (or securing slot 25) in the direction of arrow 6 and then placing the fin 11 (or 21) in the slot in the direction of arrow 5. A screw 39 may then be inserted through the lug aperture 36 and into the screw hole 33 in the direction of the arrow 7 so that the fin is secured in place in the slot 28 as shown in Fig. 11.

The fin assembly shown in Figs. 12 to 17, includes a fin 51 which is the similar to the fin 11 described in relation to Fig. 1, but with an elongated tongue 48 extending along and depending from the base of the fin and beyond the leading and trailing edges of the fin. Two apertures are provided aligned with their axes in the central plane of the fin, one in each part of the tongue extending beyond the fin. One of the apertures is a forward aperture 52 and the other aperture is the aft aperture

53.

The tongue is receivable in an alternative fin box 54 having a slot 55 with a width sufficient to bind against the sides faces of the tongue, but being extra long so that the tongue may be placed in any one of a selection of three positions, being a forward position (not shown), a central position (shown in Fig. 17), and a rear position (shown in Fig. 16).

The fore and aft apertures are fore and aft of the leading and trailing edges of the fin respectively as shown, and each receive a screw 57 which may be passed through the respective aperture and threadedly engaged in an appropriate screw hole shown typically at 56 in the base of the tongue cavity. The screw holes are formed into three pairs corresponding to the forward, central and aft positions of the fin as described above.

The fin 61 shown in Figs. 18 to 21, has an alternative tongue portion 58 which fits into a curved slot 65 matched to the curve on the alternative tongue portion and formed in an alternative fin box 64. The modified tongue portion further includes a side lug 63 with a side aperture 62 therethrough in substantially parallel alignment with the alternative tongue portion. The alternative tongue cavity also includes three screw holes 66 located to the side of the cavity, and so located with respect to the cavity that the fin may be positioned in a forward, a central, or an aft position. Because of the curvature of the cavity, the angle of attack of the fin 61 may be varied, there being two other locations for the fin as shown.

Figs. 22 to 25 shows the fin assembly 70 in which the tongue portion 48 of the fin 69 and the slot 55 of Figs. 12 to 17 is curved in a similar fashion to that shown and described with respect to Figs. 18 to 21.

Referring to Figs. 26, 27 and 28, the surfboard 84 has two of any one (or each of two) of the above described embodiments of the fin assembly in accordance with the invention set into the underside of the board. The fins are aligned with a line represented by the reference numeral 82, hereinafter referred to as the attack angle projection. In the arrangement shown in Fig. 26, the attack angle projections intersect with the longitudinal

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centreline of the surfboard at an intersection point 83a and the trailing edges of the fins are aligned with a transverse line 87a. The intersection point is on a line drawn abeam the surfboard represented by reference numeral 88a. In the arrangement shown in Fig. 27, the intersection point 83 is aft of that shown in Fig. 26, being that shown on a line drawn abeam the surfboard at 88. The trailing edges of the fins, are aligned with another transverse line 87 which is forward of the transverse line 87a of Fig. 26. In the arrangement shown in Fig. 28, the intersection point 83b is forward of that shown in Fig. 26, being that shown on another line drawn abeam the surfboard at 88b. The trailing edges of the fins is aligned with transverse lines 87b which is aft of the transverse line 87a of Fig. 26. Thus, it will be seen that moving the fins forward will move the intersecting point aft, and moving the fins aft will move the intersecting point forward, the convex side of the arcuate slot being arranged towards the outside edges of the board of the surfboard.

Referring to Figs. 29 to 39, the leg rope fitting 90 includes a U-shaped tube member 91 with both legs of the "U" passing through the deck 95 of a surfboard 84 so that the internal bore of the tube opens to the deck to form a leg rope passage. The tube passes through an aperture in the stringer 92 to give the leg rope fitting strength, and also passes through the core 93 of the surfboard 84, and penetrates the waterproof skin of the surfboard.

The tube is left longer than is required, as shown in Figs. 29, 31 and 33, whilst the surfboard is shaped, the skin of the surfboard being bonded to the tube to seal against moisture entering the core. After shaping, the tube is cut off to the level of the deck to give a smooth finish. As shown in Figs. 29, 34 and 37, the leg rope fitting may be inserted at a slanting angle, the alternative being at right angles as shown in Figs. 31, 32, 35 and 36. Because the tube passes through the stringer, the leg rope fitting is stronger, and can therefore be located closer to the tail or aft extremity of the surfboard.

As shown in Fig. 39, a leg rope 94 may be passed through the

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bore of the tube and tied off to secure same to the surfboard.

The surfboard 80 shown in Figs. 40 and 41 includes a fixed central fin 81 and two of the adjustable fin assemblies 10 on either side of the central fin, where it will be seen that the
5 fins 11 of the fin assemblies are secured in the fin boxes 12 described above. When the surfboard is in its normal orientation as shown in Fig. 41, the leg rope fitting 90 is visible, and it can be seen that the apertures penetrate the skin of the board close to the aft or tail end, making the use of a leg rope or
10 leash more convenient and lessening the likelihood of dangerous "tombstoning" of the board.

In use, a fitting of the present invention may be provided on a surfboard to provide enhanced maneuverability and/or improved attachment of a leg rope. Using the fin assembly aspect
15 of the invention, the surfer may adjust the fore-to-aft position of the fin as well as fine adjustment of the attack angle of the fin. For a change in surfing conditions or a surfer's preference, the fin may be moved by removing the screw from the securing member or lug, removing the fin from the fin box, and relocating
20 the fin in the desired location in the fin box. The securing lug is placed in the locating aperture prior to locating the fin in the desired location in the fin box, and fin may be secured in place by reinserting the screw and tightening it into the screw hole in the fin box. Using the leg rope attachment aspect of the
25 invention, a leg rope is passed through the bore of the U-shaped tube and secured by tying off the leg rope into a loop, and securing the other end of the leg rope to the surfer in the normal manner. The position and attack angle of the fins are adjusted to change the maneuverability versus the stability of
30 the surfboard in use according to the preferences, the skill of the surfer and/or the conditions in which the surfboard is to be used.

While the above is given by way of illustrative examples of the invention, all such modifications and variations thereto as
35 would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as defined by the following claims.

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CLAIMS

1. A fin assembly including one or more fin boxes adapted to be fixedly mounted in the board of a surfboard, and a fin, said fin and said one or more fin boxes having complementary locating means for locating said fin in any one of a plurality of predetermined fore and aft positions relative to said one or more fin boxes, and securing means adapted to engage with said fin and at least one of said one or more fin boxes to secure said fin in any selected one of said plurality of predetermined positions, the parts being so made and arranged that the angle of attack of said fin can be varied by locating said fin in a different or different ones of said predetermined fore and aft positions.

2. A fin assembly according to Claim 1, wherein said complementary locating means include two spaced apart projections at the base of said fin and a plurality of pairs of complementary recesses in said one or more fin boxes, each pair of recesses being adapted to receive therein said spaced apart projections and the pairs being arranged on a curve to vary the angle of attack.

3. A fin assembly according to Claim 2, wherein said one or more fin boxes is an elongate fin box and said pairs of complementary recesses are formed as part of an elongate recess, at least a portion of the sidewalls of said recess converging into the recess, and said spaced apart projections being interconnected by an elongate bridging portion extending therebetween and having side faces which converge away from the base of said fin and being adapted to bind with said side walls of said elongate recess.

4. A fin assembly according to Claim 2 or Claim 3, wherein there are three pairs of complementary recesses arranged on a curve and spaced apart so as to provide adjustment of the attack angle of about 0.6 degrees between respective pairs.

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5. A fin assembly according to Claim 4, wherein the three pairs of complementary recesses are spaced apart by 6 mm.

6. A fin assembly according to any one of the preceding claims, wherein said elongate recess and said bridging portion have a complementary curvature along their respective lengths whereby said bridging portion may bind with the side walls of said recess when said fin is in any one of said plurality of predetermined positions.

10

7. A fin assembly according to any one of Claims 3 to 6, wherein a plurality of apertures or cavities are provided in said bridging portion and opening to a side face and said securing means includes a securing member having a portion adapted to engage in any selected one of said apertures and to be fixed to said fin box.

15

8. A surfboard having a board and one or more fin assemblies according to any one of Claims 1 to 7 mounted to the board.

20

9. A surfboard according to Claim 8, wherein two fin assemblies are provided one either side of an elongate axis or a central fin of the surfboard, and wherein the attack angle is adjustable from being aligned substantially parallel to the elongate central axis to being aligned with a point normal to or along the axis aft from the bow or nose of the board.

25

10. A fin box or a pair of fin boxes adapted to be fixedly mounted in the board of a surfboard, the fin box or the pair of fin boxes together having a plurality of pairs of spaced part recesses adapted to receive therein complementary spaced apart projections at the base of a fin to be mounted in said fin box or said pair of fin boxes each pair of recesses being arranged on a curve to vary the angle of attack.

35

11. A fin having two spaced apart projections at the base of the fin interconnected by a bridging portion extending therebetween

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and having side faces which converge away from the base of the fin.

12. A surfboard having a board and one or more fins fixed to the board, the board having a core covered with a skin of water impermeable material; a stringer extending along the longitudinal axis of the board to give longitudinal strength to the board; and a passage passing laterally through the stringer and outward through the core to penetrate the skin on each side of the stringer, the passage being adapted to receive a leg rope therethrough.

13. A surfboard according to Claim 12, wherein the passage penetrates the deck of the board in close proximity to the aft end thereof.

14. A surfboard according to Claim 12 or Claim 13, wherein the passage is lined with a tubular member sealed to the water impermeable skin.

15. A fin assembly substantially as hereinbefore described with reference to Figs. 1 to 5, 10, 11 and 26 to 28.

16. A fin assembly substantially as hereinbefore described with reference to Figs. 6 to 11 and 26 to 28.

17. A fin assembly substantially as hereinbefore described with reference to Figs. 12 to 17 and 26 to 28.

18. A fin assembly substantially as hereinbefore described with reference to Figs. 18 to 21 and 26 to 28.

19. A fin assembly substantially as hereinbefore described with reference to Figs. 21 to 28.

20. A plug for a leg rope for a surfboard substantially as hereinbefore described with reference to Figs. 29 to 32, 35, 36,

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38 and 39.

21. A plug for a leg rope for a surfboard substantially as
hereinbefore described with reference to Figs. 29, 33, 34, and
5 37 to 39.

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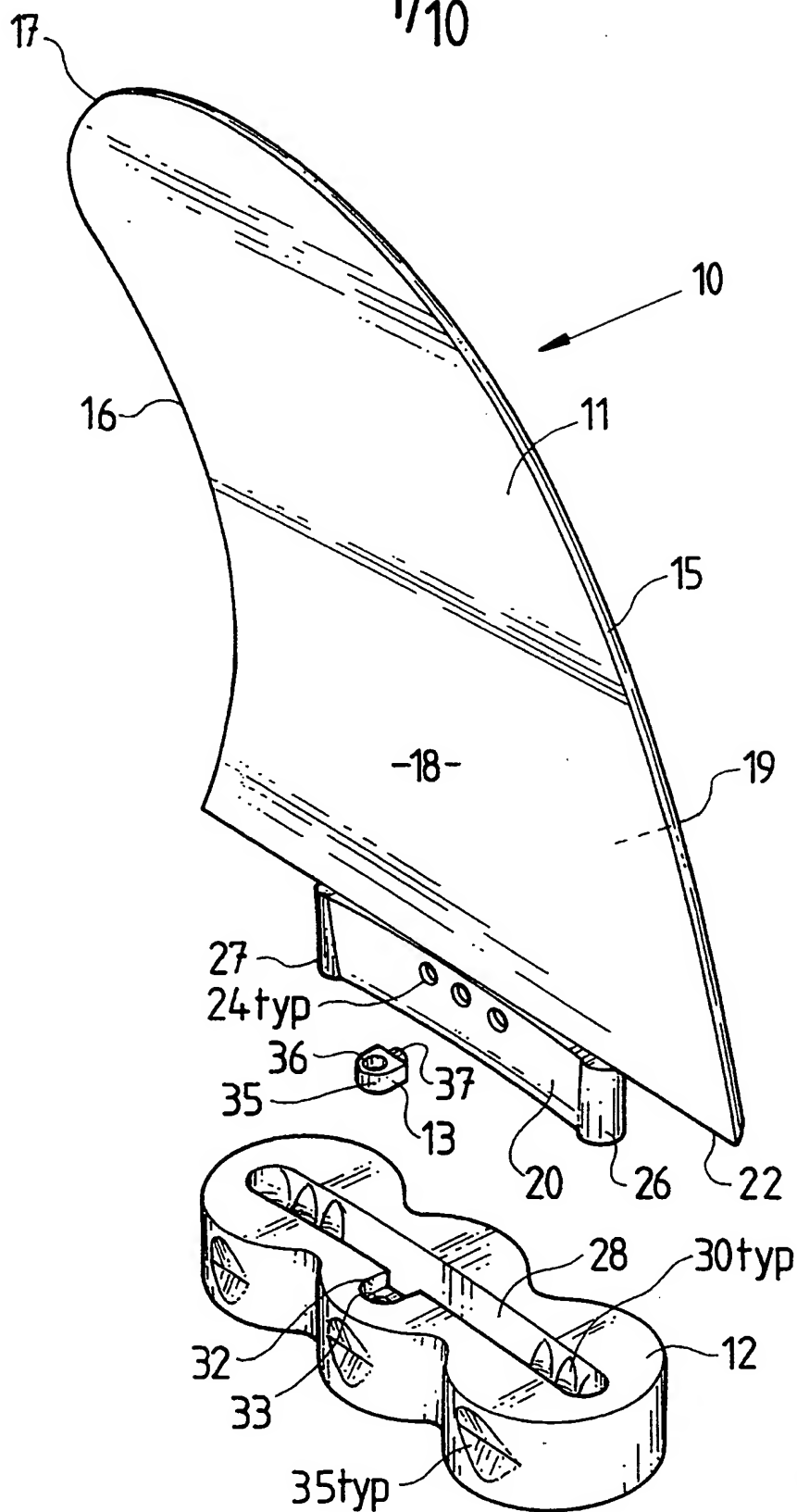
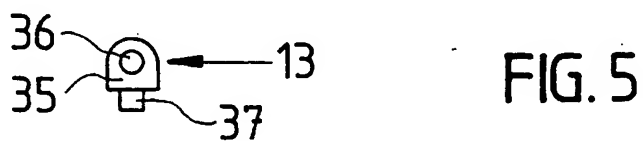
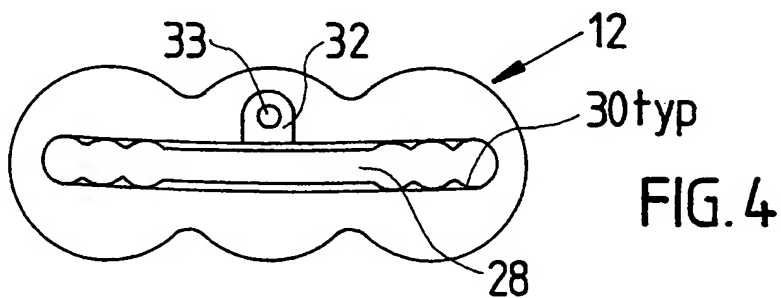
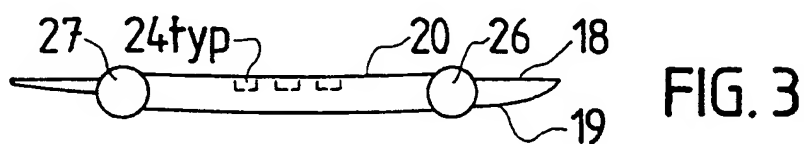
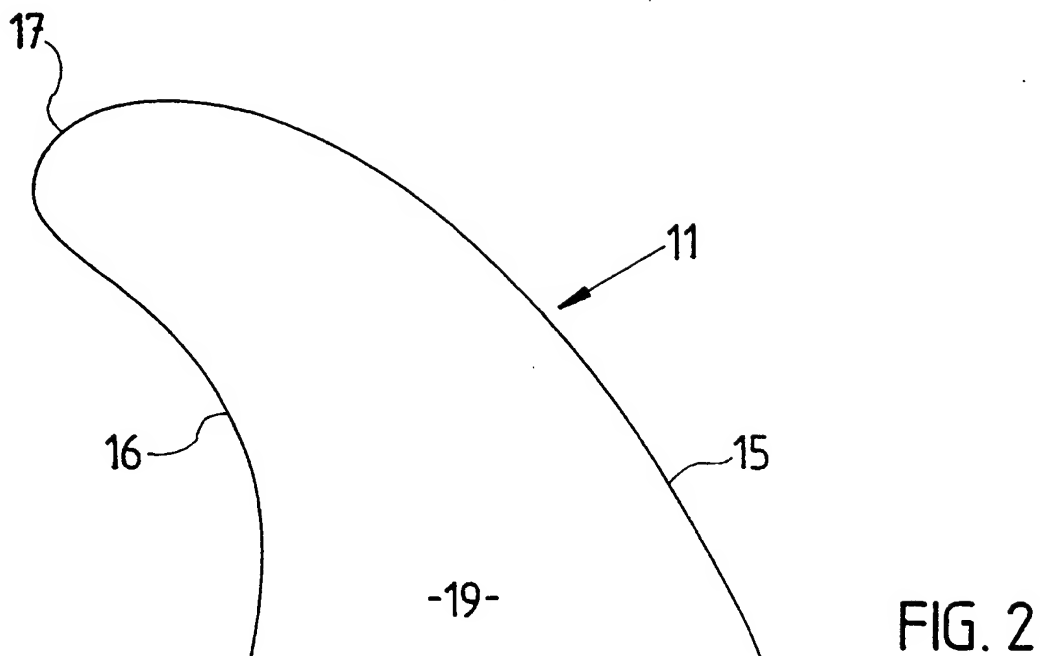
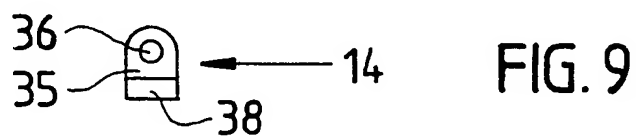
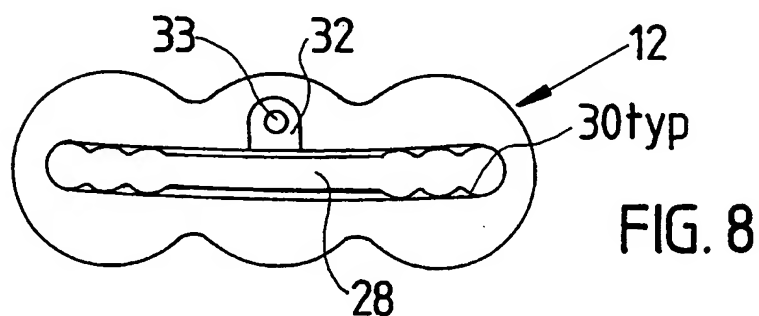
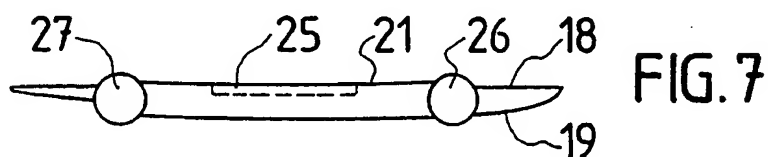
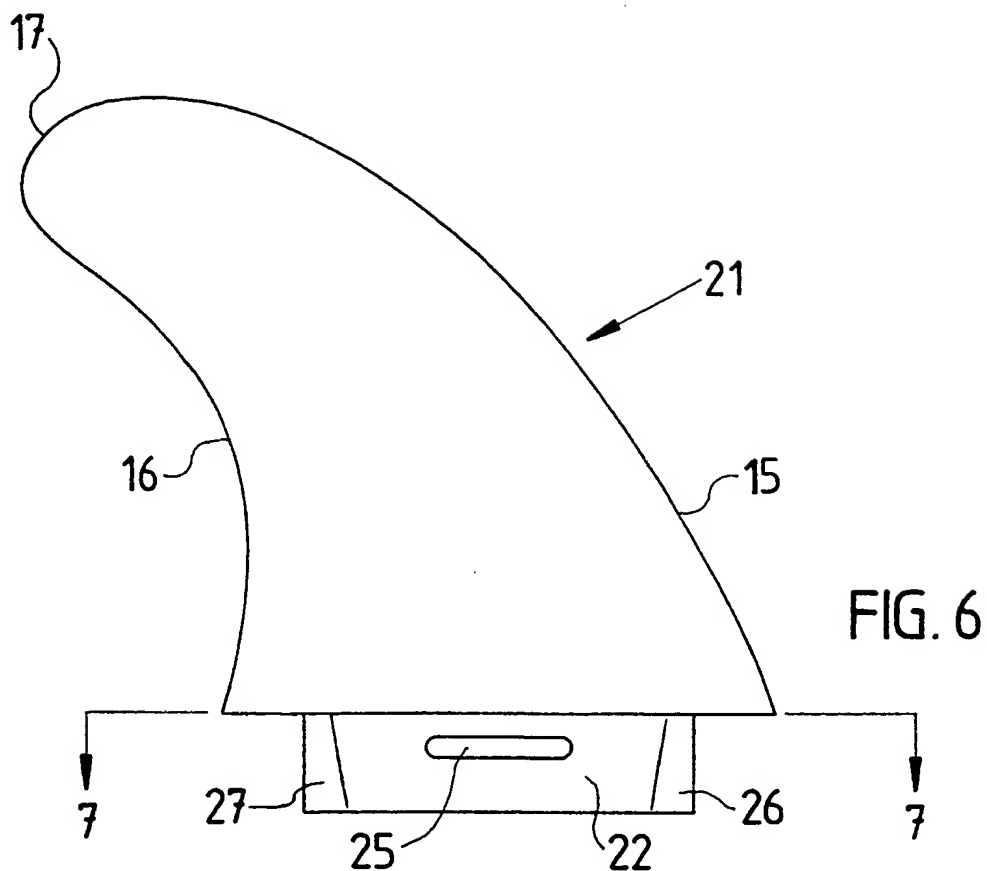


FIG. 1

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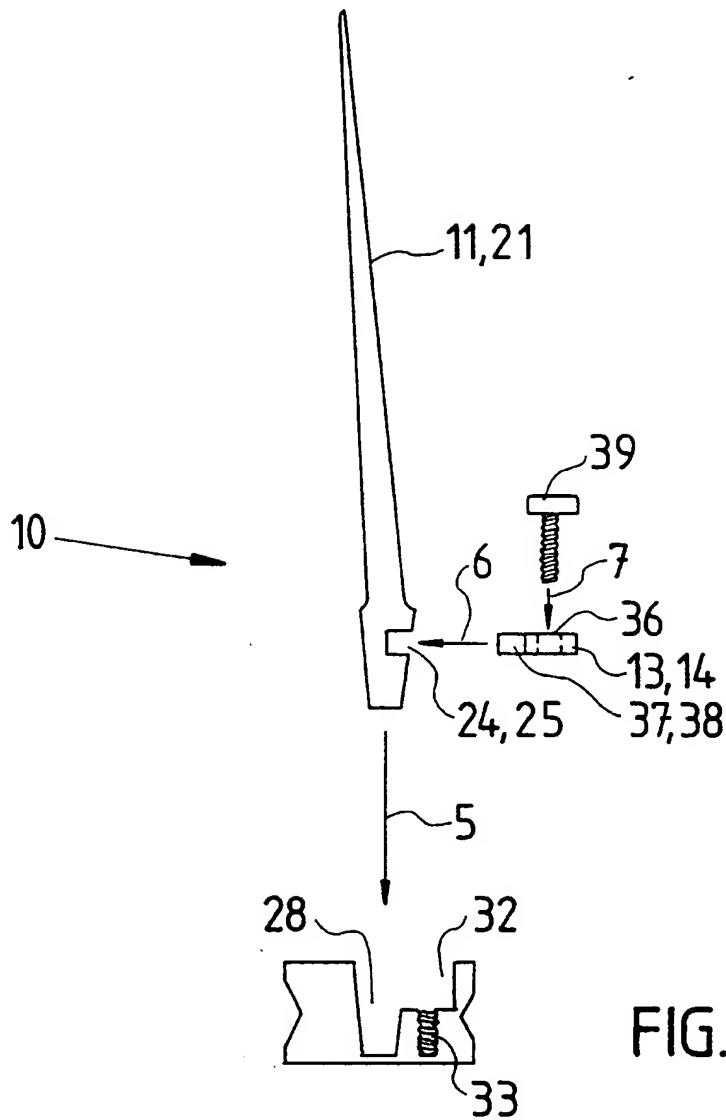


FIG. 10

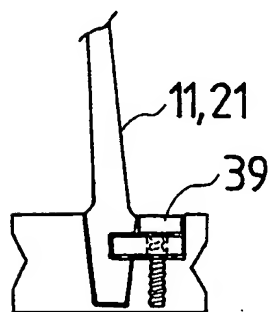


FIG. 11

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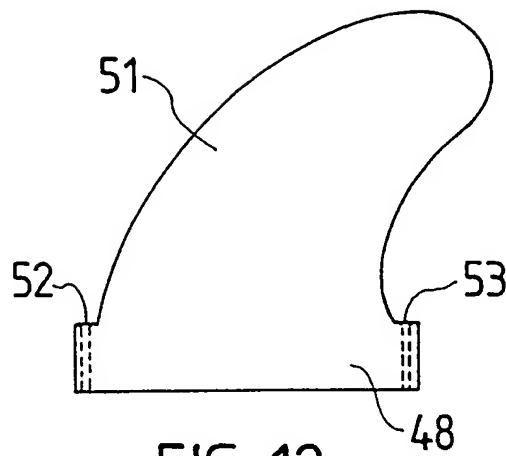


FIG. 12

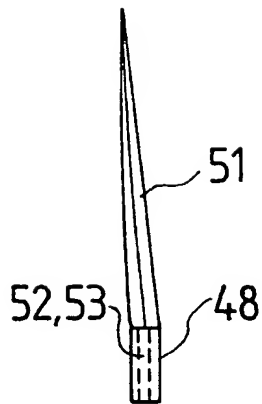


FIG. 13

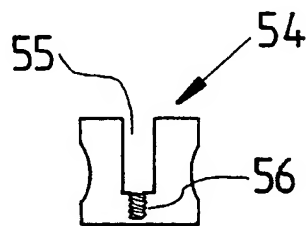


FIG. 14

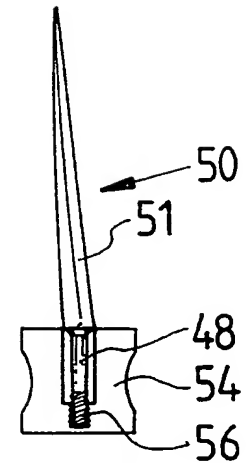


FIG. 15

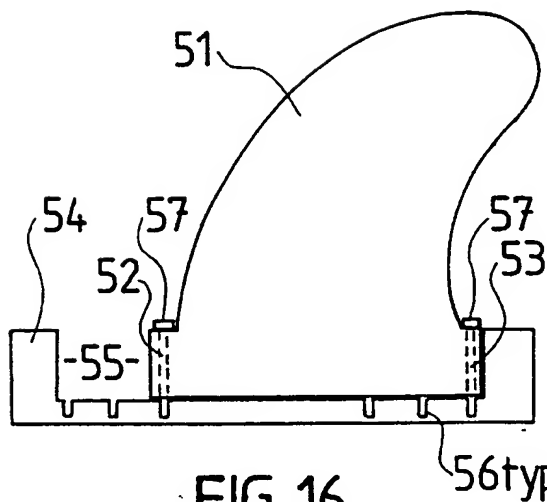


FIG. 16

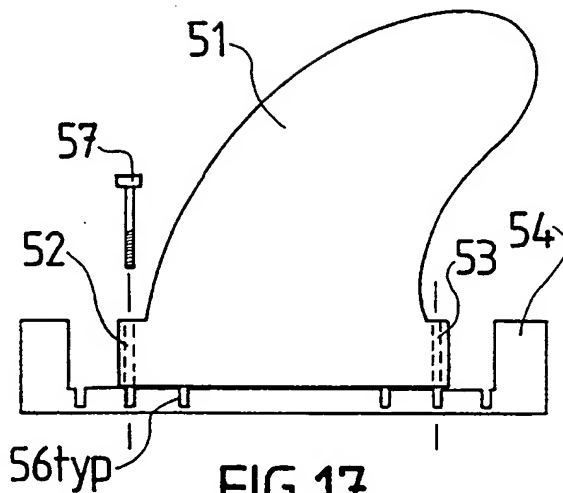


FIG. 17

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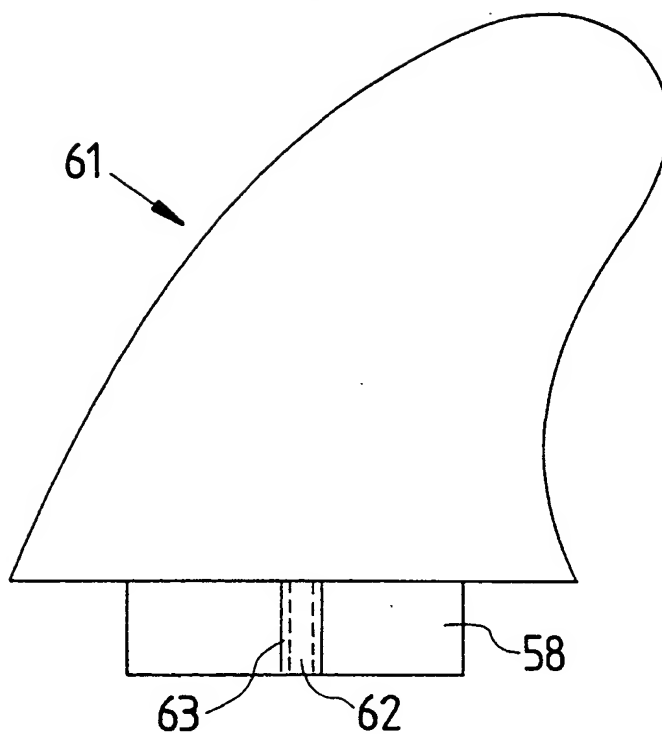


FIG. 18

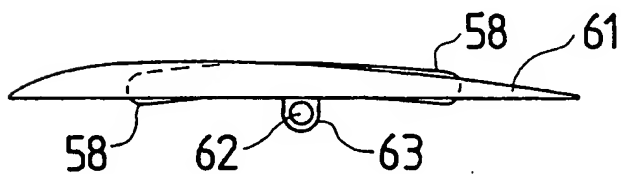


FIG. 19

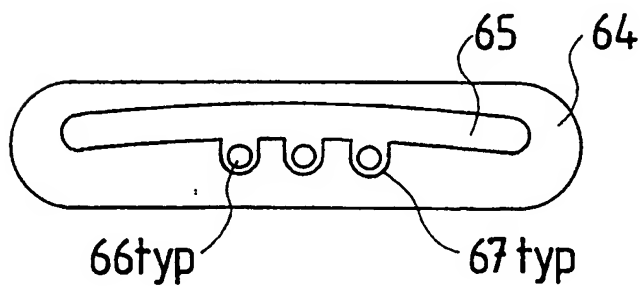


FIG. 20

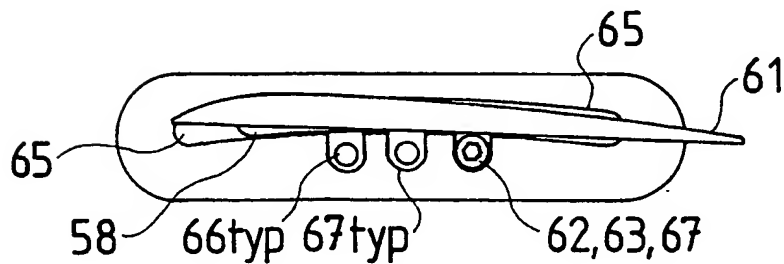


FIG. 21

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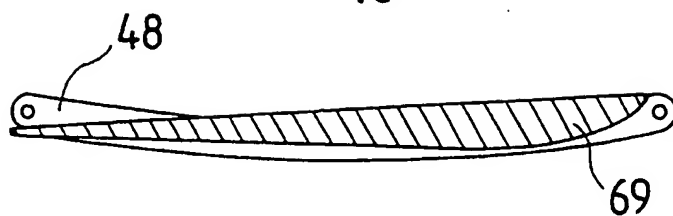


FIG. 22

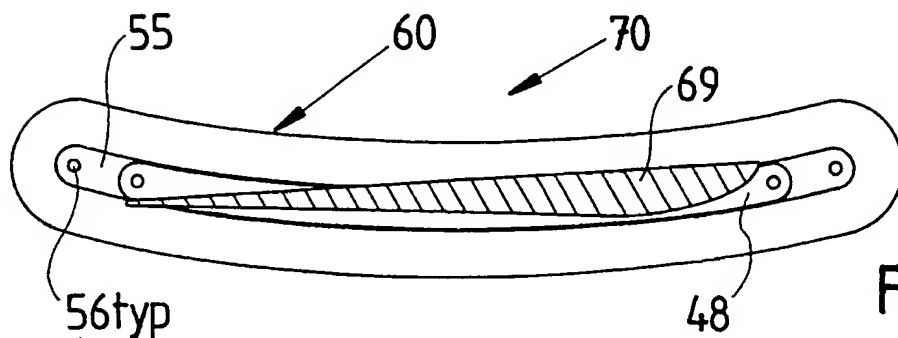


FIG. 23

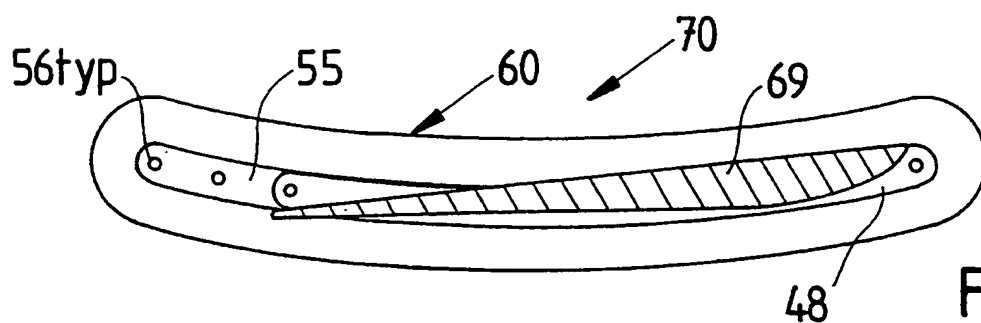


FIG. 24

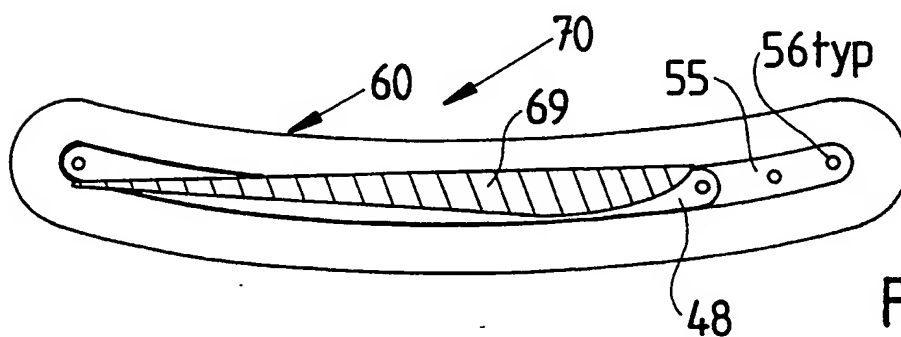


FIG. 25

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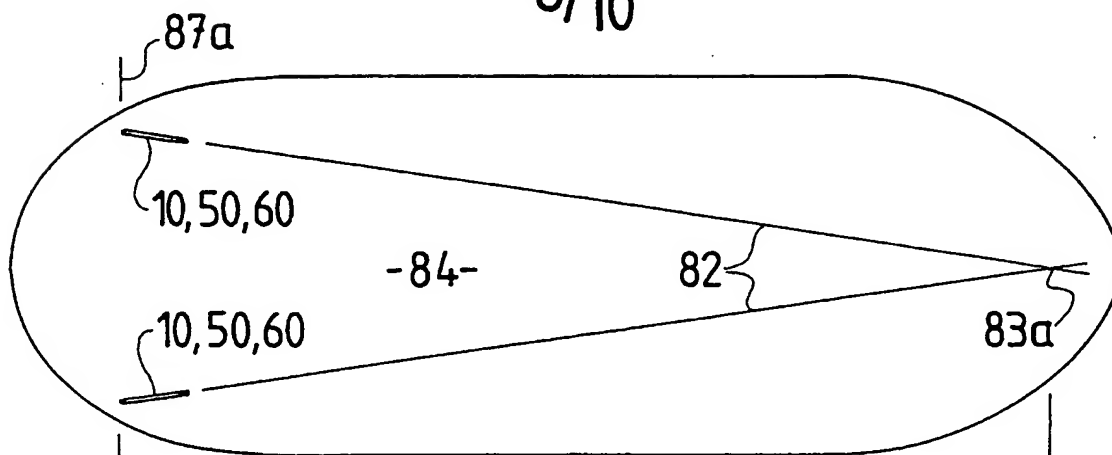


FIG. 26

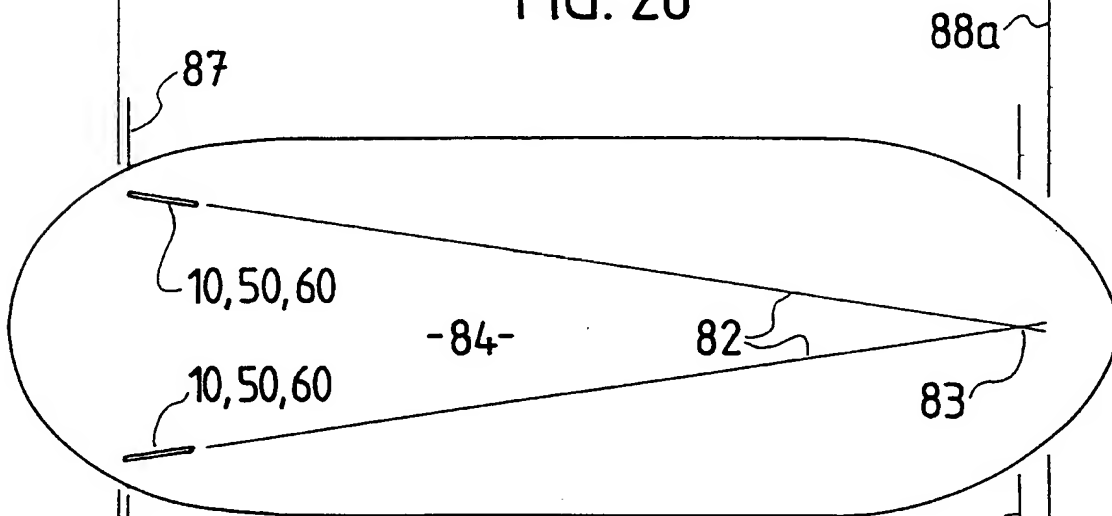


FIG. 27

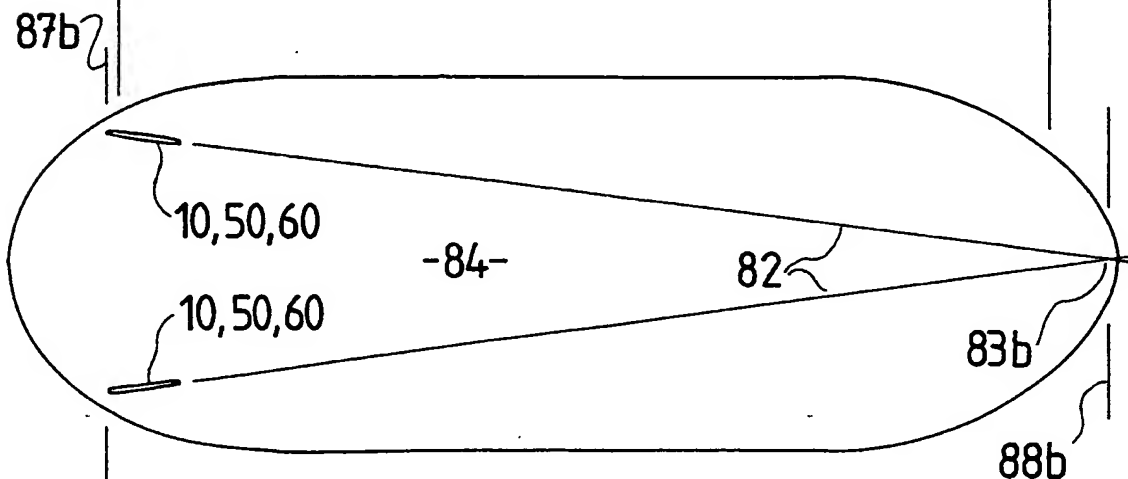


FIG. 28

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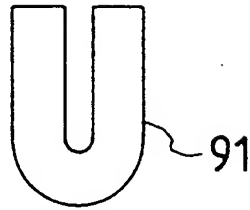


FIG. 29

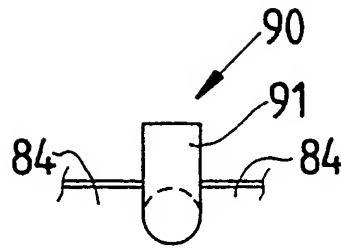


FIG. 31

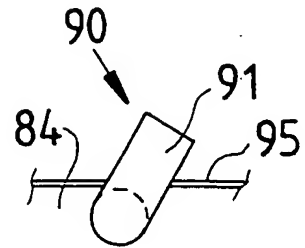


FIG. 33

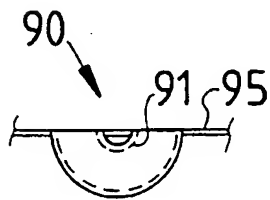


FIG. 30

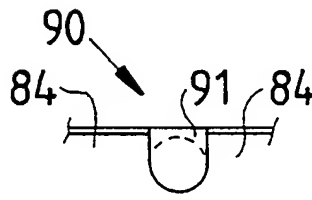


FIG. 32

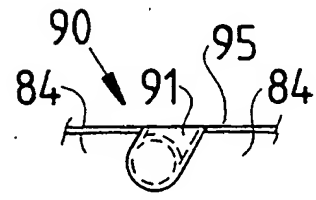


FIG. 34

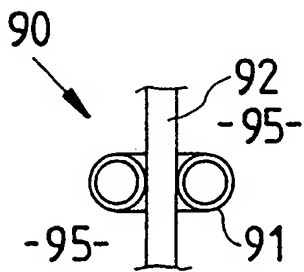


FIG. 35

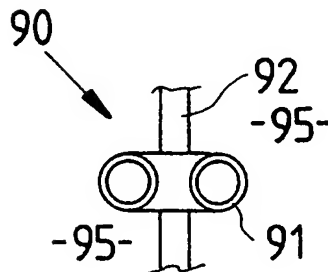


FIG. 36

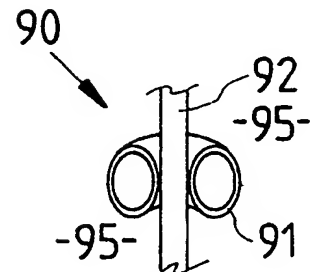


FIG. 37

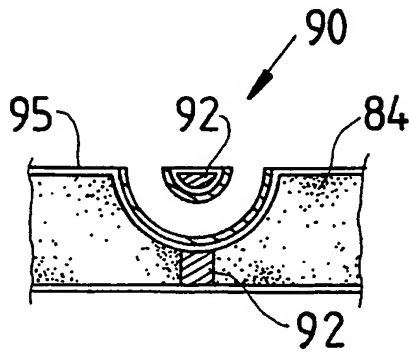


FIG. 38

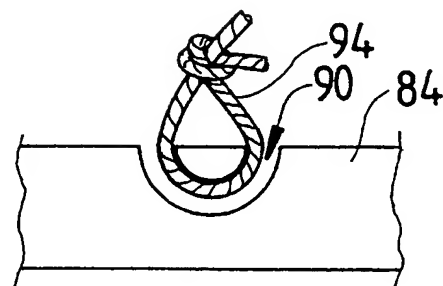


FIG. 39

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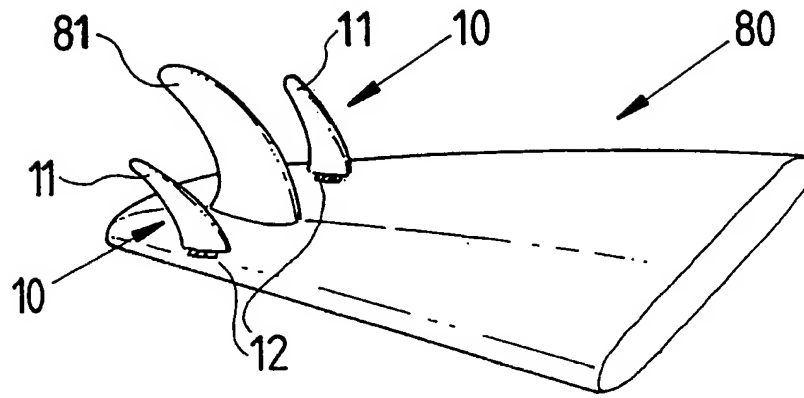


FIG. 40

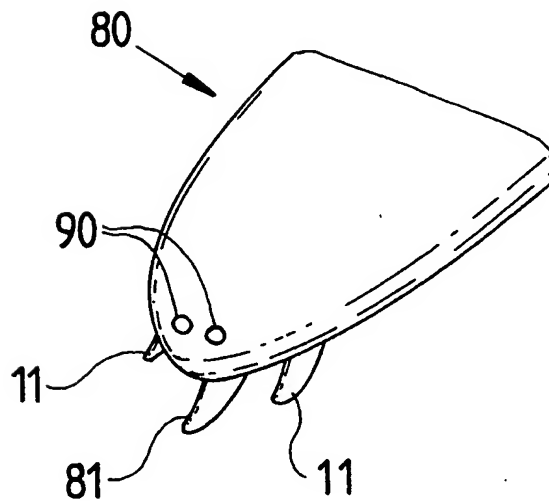


FIG. 41

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/01067

A. CLASSIFICATION OF SUBJECT MATTER		
Int Cl ⁷ : B63B 35/79		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC: B63B 35/79		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4493665 A (LIDDLE) 15 January 1985 Abstract and drawings	1,8,9
X	US 3659300 A (JOHNSON) 2 May 1972 Figures 1 and 2	11
Y	AU 84472/75 A (491811 B) (HANIMEX PTY LTD) 10 March 1977 Figure 5	11
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents: "A" Document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 04 April 2000		Date of mailing of the international search report 17 APR 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No.: (02) 6285 3929		Authorized officer SYLVAIN DESCHANEL Telephone No.: (02) 6283 2368

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/01067

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3564632 A (BAHNE) 23 February 1971 Figure 6	11
Y	US 5176096 A (MOLNAR) 5 January 1993 Figure 2	11
P,A	WO 21755/99 A1 (PAT-TECH) 6 May 1999	

INTERNATIONAL SEARCH REPORT

international Application No.

PCT/AU 99/01067

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 15-21
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 15-21 rely on references to the drawings.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-10 are directed to a fin assembly with means to vary the angle of attack.
2. Claim 11 is directed to a fin having two spaced projections and a converging bridging portion.
3. Claims 12-14 are directed to a surfboard including a passage in a stringer for a leg rope.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-11

1-11

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

International application No.
PCT/AU 99/01067

Patent Document Cited in Search Report			Patent Family Member			
US	4493665	NONE				
US	3659300	NONE				
AU	84472/75	NONE				
US	3564632	NONE				
US	5176096	EP	460438	JP	5105188	DE 4105990
WO	21755/99	AU	10108/99			